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Growing Demand for Uranium

SINCE the agreement between the Atomic Energy Commission, Britain, and Canada to make available a wide range of hitherto secret material, ranging from the operation of nuclear electricity reactors to ore production, a steady flow of new facts and figures have been published which, in total, point with increasing force to the view that the outlook for uranium, in the long term is bright and, is based on requirements essential to the continued development of industry in the atomic age.

Last week, Dr. Willard F. Libby, Commissioner of the Atomic Energy Commission, when addressing the National Western Mining Conference, in Denver, Colorado, said that nuclear reactors now projected will have an electrical capacity of more than 1,000,000 k.W. by 1962 and, moreover, the following decade would probably show a phenomenal growth in atomic power. That being so, the Commissioner estimated that within a decade or two, U.S. requirements would probably amount to some 25,000 tons of uranium oxide per year, with world requirements ranging from 40,000 to 100,000 tons. This contrasts with the anticipated output of the free world next year of around 30,000 tons of uranium oxide.

Primarily, the demand for uranium in the future would be for inventory and he pointed out that the equivalent of 100 tons of uranium for the core of a reactor requires an additional 200 tons, for the recycling operation. Present reactor designs generally require the equivalent between 0.2 and 2.5 tons of natural uranium for each megawatt installed capacity for their initial inventory.

On reasonable assumptions the total requirements of uranium oxide by 1975, he believed, could be as much as 75,000-100,000 tons. At that time, the yearly off-take might very well be in the range of 20,000-30,000 tons of uranium oxide, which compares with the production figure for 1956 of 6,000 tons and with the projected production target of at least 15,000 tons by 1958.

One of the chief reasons for the declared scepticism concerning the long-term outlook for uranium is based on the idea of fast breeder reactors producing more fissionable material than is consumed. These types of reactors are, of course, undergoing tests in many different parts of the world. But, as Dr. Libby points out, even though they can use thorium or depleted uranium, as well as natural uranium, they will require U 235 or its equivalent (PU 239 or U 233) for their initial inventory which could be very large. In any event he welcomed the advent of such reactors, as they would eventually contribute towards the supply of fissionable material for the initial inventory of other reactors. The Commissioner considered this as most important, as a reduction in the demand for U 235, required for the initial inventories of new reactors would be reflected in the demand for natural uranium.

While it would be foolish to dismiss the idea of hydrogen reactors, this achievement appears so remote that it does not constitute a threat to the future growth of the uranium industry. Its place in the scheme of future nuclear power arrangements can

best be described by quoting from an A.E.C. report which states "that such a reactor is purely of academic interest for the foreseeable future".

Of more immediate concern is the time—some years hence—when the transition from military markets to the civilian power markets has to be made. In this context it ought to be borne in mind that the U.S. domestic uranium purchasing programme has been extended from March 31, 1962, to the beginning of 1967, and it is the view of Senator Anderson, Chairman of the Joint Committee on Atomic Energy, that it is up to the U.S. government to prevent a sag in the uranium market if military requirements fall away before civilian power programmes commence, as the development of atomic power is in the national interest.

SCRATCH AUSTRALIA AND YOU FIND MINERALS

Despite the considerable standing of the Australian mining industry, it may well be that the Commonwealth's greater mineral wealth as yet remains untapped. This belief is borne out by the important phase of Australian prospecting that is now commencing. Several large companies are beginning an active search for minerals in widely scattered parts of the country.

Notable amongst these companies is The Broken Hill Proprietary Co., commencing a large-scale campaign for the discovery of iron ore in North Queensland where rights over two areas totalling 6,300 sq. miles have been granted by the Queensland government. One of the areas to be searched is on the east coast of Cape York Peninsula and will probably include the iron ore occurrences in the vicinity of Portland Roads. The other area is on the Queensland—Northern Territory border in the Constance Range. The town of Mount Isa is being used as a base for this phase of the operations.

BHP's prospecting will not be limited to a search for iron ore, however, as the company holds rights to prospect for all minerals over an area of 1,800 sq. miles in the Iron Range district of Cape York Peninsula.

The second company undertaking large-scale prospecting is Mount Isa Mines. This company intends to explore an area of 6,000 sq. miles of North-Western Queensland for copper, uranium, silver, lead, zinc and other minerals. Approximately 300 men will be employed in the prospecting campaign.

A third prospecting venture will be carried out by a group of three mining companies, namely King Island Scheelite (1947), Loloma (Fiji) Gold Mines N.L., and United Uranium N.L. The last-named group has several properties in Northern Australia under consideration. Arrangements have been made to begin work at Tennant Creek in the Northern Territory on a large anomaly disclosed by magnetometer survey.

There seems to be no end to the reports of new mineral finds in Australia. Notwithstanding the obvious possibilities indicated by these reports of new searches, it is now disclosed that the Commonwealth Bureau of Mineral Resources has located an extensive anomaly on the western border of North Queensland. The anomaly, discovered by scintillometer survey, is about 200 miles from Mount Isa.

This latter discovery is regarded as possessing distinct possibilities, and is being investigated by Mount Isa Mines Ltd. Work so far completed has uncovered torbernite and copper over a wide area, although any accurate idea of the probable value of the locality cannot be formed until more detailed work has been carried out.

In addition to the Australian development, New Zealand is to be the venue of exploration activity this year. Despite the unsuccessful study and effort directed to the discovery of oil on the east coast of North Island, a fresh effort is to be made during 1957. Three companies are said to be interested in exploring the area, namely the Shell Company, British Petroltum and Todd Brothers. In addition to North Island, a part of South Island will also come under review.

British Petroleum, in association with Todd Brothers, holds a concession of 12,586 sq. miles, and Shell, in conjunction with other companies, holds a concession of 5,574 sq. miles in the Taranaki-Rangitikei area. It is here that the first drilling is expected to be carried out. The largest known oil seepage has occurred in this district and gravity meter surveys have disclosed interesting information. In Taranaki, fifty wells have been sunk since exploration was commenced in 1865. Four of these have produced a small quantity of oil.

STRATEGIC MINERALS FROM PACIFIC NORTHWEST

Certain water-deposited minerals which were regarded a few decades ago as nuisances by miners working gold placers in the Pacific Northwest to-day are adding to the U.S. supply of strategic materials, reports a Bureau of Mines survey. These minerals can be expected to contribute even more to the economy as local industries are developed.

Chromite is being recovered from Oregon alluvial deposits, according to the report, and columbite-tantalite and "radioactive blacks" are being mined in Idaho. The term "radioactive blacks" describes dark sands containing columbium, tantalum, uranium, thorium, and certain rare earths.

Other minerals present in the alluvial deposits in recoverable quantities include ilmenite, zircon, monazite, magnetite and garnet. Thorium was formerly sought primarily for use in gaslight mantles but present interest centres on its capabilities as a source of nuclear energy.

Monazite dredging in Idaho began in 1951 but ceased at least temporarily about a year ago because of a price reduction. Chromite production in Oregon is active, but is based on the government's purchase programme which is due to end June 30, 1957, or when the General Services Administration's purchasing depot at Grants Pass, Oregon, has received 200 l.tons, whichever is earlier.

In general, the report says, development of Pacific Northwest alluvial deposits will depend upon recovering several of the valuable minerals, and this, in turn, will depend upon the availabilty of markets within a reasonable distance. It notes that shipping costs have made it difficult for titanium and zirconium concentrates from the area to compete in Eastern markets.

The report describes the alluvial deposits in each of the four States and outlines the technology and uses of the heavy minerals found in them. It also notes that the availability of low-cost hydro-electric power, a wide selec-

tion of possible plant sites, and other desirable features give the Pacific Northwest greater promise for industrial growth.

MORE THOUGHTS ON STEEL

Since the Federal government's refusal of special tax concessions to encourage expansion projects, some of the Molochs of the American steel industry have been talking of "a re-appraisal" of their plans. The problem of financing expansion is certainly formidable. It is estimated, for example, that over a billion dollars must be spent in each of the next five years merely to replace worn out and obsolete plant whilst the total recoverable amount under existing depreciation allowances will fall short of replacement costs by about three billion dollars.

There are other difficulties besides that of finance. Indeed, it was a British steel magnate, Sir Ellis Hunter, chairman and managing director of Dorman Longs, who recently emphasized the intensification of the competition for ores of suitable quality. Speaking of the possibility of a shortage of raw materials and of transport he said:

"The United Kingdom is not the only country importing iron ores: there are other industrial nations which have large and growing needs. Although steps are being taken to develop new sources of supply the ore will have to be transported to the United Kingdom by sea. Here again future shipping needs have been anticipated to some extent but there is no certainty that cargo-carrying capacity will be readily available for any rapid increase in imports.

"A realistic assessment of these factors is essential when considering long term prospects for expanding steel production. The difficulties are probably not insuperable but they are very real, and should check facile expectations of large steel output increases year by year comparable with those achieved over the past decade."

Given the need these difficulties can be mastered, and the determination to do so is implicit in the approved projects for the provision of extra capacity in the old world and the new. The list is profoundly impressive.

Germany's resurrection as a great centre of steel production was clearly demonstrated a year ago when, for the first time since the war, German output exceeded that of the U.K. The Western Zone has since increased its lead. In 1956 British ingot output totalled 20,700,000 tons. This was 800,000 tons short of the target. In the meantime Germany's output in 1956 was 23,200,000 tons of ingot steel and production this year is expected to rise by a further 8 per cent to more than 25,000,000 tons.

The principal factor in this expansion is continued investment which is encouraged by liberal tax allowances. In 1956 about 51 per cent of the total investment was spent on rolling mills, 18 per cent on ingot steel and 17 per cent on pig iron production.

In Japan the industrial renaissance is even more impressive. The Land of the Rising Sun has rapidly assumed a leading rôle in the shipbuilding industry and dependent though it is upon the regular delivery of large tonnages of iron ore and scrap, the iron and steel industry reached a new record in steel production in November with a month's output of over 1,000,000 tons.

Judged by the same standards of achievement, China lags far behind her island neighbour with an annual output of 5,000,000 tons. But the sleeping giant has been raised from his slumbers. The exploitation of its vast mineral wealth has begun. From new discoveries of coal and the expansion of existing facilities, coal production has been increased from 80,000,000 to 113,000,000 tons in a year.

Recent surveys also reveal that China's iron reserves amount to not less than 3,100,000,000 tons which is believed to be sufficient for anticipated industrial demands for the next 60 years. New iron deposits have been located in Szechuan and the North West and Chinese iron production is now estimated at 6,000,000 tons per annum, and it is hoped that a second Five-Year Plan—curious how the steel industry thinks in terms of quinquennia—will raise ingot production to 11,000,000 tons per annum.

With unspecified targets, the Austrian firm of Voest has embarked on a big expansion programme which includes the provision of a new furnace and a second oxygen steel plant.

Israel has passed its first milestone in its industrial journey by the starting of the first furnace at the steel melting plant at Acre and although handicapped by the low quality of the available ore supplies and consequent high costs of production, it is somewhat vaguely hoped to ultimately attain an annual output of 100,000 tons of finished products. This includes reinforcement bars, marabout sections and rounds for the extrusion of seamless tubes in quantities sufficient for local needs.

Latin America claims to have trebled its steel consumption in 20 years. Its total use of steel now amounts to 6,600,000 tons anually and may be doubled or even trebled in the next ten years. Of the steel currently consumed 62 per cent was imported. Steel capacity is now rated at 3,400,000 tons per annum and it is affirmed that programmes already in hand will lift the total to 6,400,000 tons in 1960.

EUROPE'S WIDENING ENERGY GAP

A preliminary statement issued by Euratom's "Three Wise Men"—appointed in November last year to report on the quantities of atomic energy which can be produced in the European Pool countries—has spotlighted the future necessity of nuclear power if Europe's industrial development is to continue along its present lines. The committee of three has just completed a tour of the six Pool countries and forecast that by 1975 imports of coal or its equivalent will be running at 260,000,000 tons a year—35 per cent of total energy needs.

This figure is arrived at even after making due allowances for increased indigenous conventional fuel production and suggests that unless nuclear power can take over much of this load the economic structures of the European Coal and Steel Community wil be badly shaken. The Euratom Committee point out that without mutual co-operation between the Community, U.K. and U.S.A., development in the field of nuclear power cannot make any significant contribution to energy requirements until 1970-75. The only way to stabilize energy imports at an earlier date is to effect this close association and thereby enable a larger production programme to be undertaken.

In Britain the whole problem of future availability of atomic power, estimated fuel imports, projected coal output, etc., is so wrapped up in "ifs and buts" as to make accurate forecasts well-nigh impossible. Developments in the nuclear power field are going ahead much faster than was envisaged a decade ago, and possibly ten years' hence, present-day estimates of atomic energy's contribution in 1967 will have been proved to be too modest. However, whatever happens Britain will still need every ton of coal that can be home produced.

Selenium and Tellurium Recovery from Canadian Ores

Selenium and tellurium occur as copper selenides and copper-gold tellurides in the copper-nickel ore of the International Nickel Company of Canada. Both metals are present in such exceedingly small quantities that no attempts are made to determine the amounts. The methods used to recover them were described by L. E. Djingheuzian at the Symposium on the "Extraction Metallurgy of Some of the less Common Metals", held by the Institution of Mining and Metallurgy on March 22 and 23, 1956.

THE selenium and tellurium which are recovered in the copper flotation concentrates at the Copper Cliff concentrator as selenides and tellurides are collected in the blister copper after copper concentrates are smelted. Inco's blister copper is transported in molten condition from the Copper Cliff smelter to the copper refinery in specially designed cars. The molten blister copper is charged to the anode furnaces where the refining process begins. When the furnace is almost or fully charged, the bath with the slag on top of the molten metal is covered with coke breeze and poling is started to reduce the oxygen content of the metal and also copper content of the slag. When this operation is considered complete, the slag is skimmed off, crushed, sampled, and shipped back to the smelter for recovery of metals which are in it.

Once the bath is skimmed free of slag, it is covered with coke (pea size) to prevent further oxidation. Then poling takes place again to reduce the oxygen content of the anode metal from 0.8-0.9 per cent to 0.05-0.08 per cent, after which anodes are cast. The copper content of the anodes is 99.18 per cent.

The anodes, which weigh about 580 lb. each, go to the tank-house where they are placed in the electrolytic tanks. The anodes remain in the tanks for 28 days. At the end of this period, scrap which remains and is 12½ per cent of the original weight of the cathodes produced, is removed and returned to the anode furnace.

Selenium and tellurium which are contained in the anode do not go into solution in the electrolyte. They remain insoluble and drop as part of the electrolytic slimes to the bottom of the tank. These slimes, after the electrolyte is syphoned out of the tank, are flushed through a bottom opening and pumped to the silver refinery for the first step in separation of selenium and tellurium.

The amount of slimes produced is 8.3 lb. per ton of anodes corroded. The major impurities in these slimes are copper and nickel. In addition to selenium and tellurium the slimes contain lead, gold, silver, platinum metals, and traces of arsenic, antimony, bismuth and iron. A size analysis shows the slimes to be all minus 200 mesh.

Initial Stages in Extraction

The slimes from the tank-house are pumped by a 2½ in. vertical lead pump with 24-15 Mo shaft and impeller to a settling tank in the silver refinery. From the settling tank the slimes go to a drum filter for dewatering. The overflow from the settling tank and the filtrate are returned to the tank-house. 2 lb. of 66 deg. Bé sulphuric acid, a little over the stoichiometric ratio required for sulphating the base metals per lb. of slimes on dry basis, is added to the filtered slimes which are then roasted in a tray roaster furnace at 700-1,000 deg. F. The flue gases from the tray roaster are treated in a water-spray scrubber and wet Cottrell plant. Forty-five per cent of the selenium content of the slimes is recovered as selenious acid (H_2SeO_3) in the scrubber and Cottrell solutions which average 125 g. of selinium and 1-3 g. of tellurium per litre of solution. The scrubber and Cottrell solutions go to storage tanks and thence to the precipitating agitators after filtering.

The roasted slimes, now containing most of the base metals as sulphates, are leached with water, the leach liquor going to a cementation tank. Copper powder is used for cementation, in which process tellurium is concentrated in the cementation slimes. The solution is returned to the electrolytic tanks in the tank-house and the cementation slimes are sent to the tellurium circuit.

The leached roasted slimes containing 10 per cent moisture are fluxed in 800 lb. batches with 50 lb. of soda ash and minus 40 mesh silica, the amount of which, depending on the lead content of the slimes, varies from 30 to 70 lb. for each batch. The charges thus made are charged to a Doré furnace, the charging period varying from 100 to 150 hours depending on the number of charges. During the charging period the slag containing mostly lead and some of the other base metals remaining in the slimes is skimmed off and sent back to the anode furnace.

After the charging is complete and all the slag is skimmed off, refining which lasts from 45 to 95 hours is started. This operation consists of the oxidation of the matte bath with air and nitre ($NaNO_3$) and two products are obtained: (1) Doré metal containing gold, silver, and platinum metals, which is sent to the silver parting plant, and (2) nitre slag in which some of the selenium and tellurium is recovered as selenites and tellurites of sodium. The consumption of nitre per lb. of Doré metal produced varies from 1.05 to 1.60 lb. The balance of the selenium and tellurium is recovered from Doré flue gases.

The Doré flue gases containing volatilized selenium and tellurium pass through a chamber in the flue system, then to a wet scrubber before passing to a wet Cottrell. Part of the volatilized selenium, which is oxidized to selenium dioxide during volatilization, on cooling in the chamber crystallizes in needle-like crystals which are deposited on the walls of the chamber. These crystals, known as selenium whiskers, contain about 55 per cent selenium and are readily soluble in water with which they form selenious acid:

$$SeO_2 + H_2O \rightarrow H_2SeO_3$$

Selenium and tellurium, entering the flue system with the gases, are passed through a wet scrubber and Cottrell and the solution is sent to storage. Since the Cottrell and scrubber solutions contain about 60 g. of selenium per litre of solution, they are passed first through a steam evaporator to concentrate to 125 g. of selenium per litre, and are then sent to neutralizing tanks.

The selenium whiskers and the nitre slag are leached with water. Water leaching of nitre slag produces a solution containing selenium and tellurium as selenites and tellurites. The resulting solutions and sludges are passed through a plate-and-frame filter press, and the filtered sludge is returned to the Doré furnace to join the charges to it.

The filtered solution from the selenium whiskers and nitre slag go to storage and thence to neutralizing tanks.

Selenium Circuit

The purpose of the neutralizing tanks is to separate selenium from tellurium. Sulphuric acid or Doré scrubber solution is added to the nitre slag solution to make it acid and then it is neutralized with soda ash until it shows no effect either on red or blue litmus. After thorough agitation the neutralization of the solution precipitates tellurium and also lead and copper impurities as carbonates.

Since the tellurium is soluble on either side of the neural point, a conclusive control test for ascertaining the complete neutralization of the solution is used.

The neutralized solution is passed through a plate-and-frame filter press. The filtered sludge, containing tellurium and base-metal impurites, after water-washing, goes to the tellurium circuit and the filtrate solution to a storage tank. This solution contains about 125 g. of selenium and 0.75 g. of tellurium per litre.

For the reduction of sodium selenite and selenious acid to metallic selenium by sulphur dioxide in the sulphuric acid solution, treatment of the solution is based on the following reactions:

$$Na_2SeO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2SeO_3$$
$$H_2SeO_3 + 2SO_2 + H_2O \rightarrow 2H_2SO_4 + Se$$

From the storage tank, the solution is charged to the precipitators, which are impeller-type agitators, where it is made up to 12 per cent sulphuric acid with the addition of the appropriate amount of 66 deg. Bé acid. Heat is generated by this process and the solution is cooled by water circulating through the cooling coils placed inside around the walls of the precipitator.

After the temperature of the solution is brought down to 80 deg. F., gassing is started using sulphur dioxide at such a rate that the temperature of the solution does not exceed the 80-85 deg. F. range. Gassing is continued for a period of 8-10 hours, at which time the selenium content of the solution has been reduced to approximately 5 g./l. The reaction is considered complete although the precipitation of selenium is not complete. Continued gassing would throw out the tellurium contaminating the end product. At this stage the selenium is in the red amorphous form. At this point 75 lb. of black finished selenium is added to the agitator. The addition of this material prevents the agglomeration of the red amorphous selenium while it is being charged to the grey granular type by heating the solution to 160 deg. F. After the transformation the spent solution is decanted. The selenium is given one water wash in the agitator and then discharged into a suction box where additional washes are made. In order to remove the last traces of free acid, the selenium is charged into a 26 in. Tolhurst centrifuge and washing is continued until the effluent shows no trace of residual sulphates. The spent solution after precipitating the selenium, analyses 5 g/l of selenium, 0.04 g/l of tellurium and 380 g/l of sulphuric acid. This solution is concentrated to 50 deg. Bé in a lead evaporator and then sent to a cooling tank where the contained sulphate is crystallized out. The concentrated acid is syphoned off and used in the roaster furnace while treating raw slimes. The sodium sulphate is discarded.

The selenium, after this final washing, is shovelled into enamel-ware pans and dried in steam dryers for 24 hours. The dried selenium is screened on a Rotex screen through 200 mesh, and the small amount of oversize is ground in a small Micro pulverizer and returned for rescreening. The undersize material is sampled and kept in steel boxes until the samples are analysed.

A typical sample has the following constituents: Selenium 99.70 per cent, tellurium 0.12, copper 0.001, iron 0.01 and ash 0.13. This product is marketed in 100- and 500-lb. kegs.

Tellurium Circuit

The crude tellurium sludge from the selenium circuit is fed in 2,000-lb. batches to a leaching tank to which about 100 cu. ft. of cold water is added. This mixture is agitated to keep the solids in suspension and caustic soda is added until a pH of 12.5 is attained, when the colour of the suspended solids changes from grey to dark brown. This indicates that light-coloured tellurium oxide has gone into the solution as sodium tellurite, leaving behind dark base-metal hydroxides in suspension. The solution and base-metal hydroxides are filtered by means of a filter press and the filtrate is discharged into a neutralizing tank. The sludge is returned to the Doré furnace.

In the neutralizing tank, into which the product is also charged, obtained by leaching with caustic soda of the roasted water-leached cementation slimes, the caustic solution is neutralized with dilute sulphuric acid. This precipitates tellurium oxide, lead sulphate and some silica, while the selenium stays in solution. After settling, the solution is decanted and sent to the evaporator in the selenium circuit. The crude tellurium oxide is washed four times with water and then re-dissolved with caustic soda solution. In this operation the amount of caustic soda is closely controlled in order not to dissolve silica.

The solution is filtered through a suction filter and the sludge sent to the Doré furnace. The filtered solution goes into the second neutralizing tank where it is heated to 180 deg. F and neutralized with dilute sulphuric acid. This precipitates almost pure tellurium oxide which is thoroughly water-washed, wash-water being decanted and sent to waste. The tellurium oxide is dewatered in a suction filter, placed in enamel-ware pans and dried in a steam drier.

After sampling, the dried oxide is fluxed with flour and borax and heated in a covered crucible in a tilting furnace. The charge is made up of 150 lb. of tellurium oxide, 31 lb. of grain flour and 15 lb. of borax thoroughly mixed and is charged to the furnace. In addition, as a cover, 3 lb. of borax is spread over the top of the charge.

Reduction of the tellurium begins at a comparatively low temperature indicated by white fumes of the oxide which are continually given off during the reduction period. The reduction is complete at a dull red heat when the fuming ceases and the molten metal bath is totally covered by the borax slag. The melt is now ready for casting, iron moulds being used for this purpose. However, since the hot metallic tellurium readily combines with iron, some slag is poured first into the mould to protect it, and then the molten tellurium. Tilting of the furnace is controlled from an adjacent room so that the operator is not exposed to the fumes evolved during pouring.

After cooling, the bar is dumped from the mould, the slag is chipped off, and the metal is sampled by making four saw cuts in the bar. The bar weighs about 100 lb. A typical sample assays 99.75 per cent tellurium with 0.04 per cent selenium and a trace of lead.

The bars are boxed before shipping to market. Sometimes when tellurium is required in pulverized form, it is ground in the Micro pulverizer, screened on the Rotex screen to specifications, generally to minus 200 mesh, and shipped in 200 lb. kegs.

South African Shaft Sinking Techniques

SHAFTS are likely to come into the forefront of South African mining news in coming months. From all that can be learned the most important advance in shaft-sinking techniques is the exploitation of the system of cementation by means of a ring of boreholes around the shaft site to a depth of up to 1,500 ft. This was originally developed at St. Helena and is aimed at sealing off any water-bearing fissures or mud-filled chambers in the shaft area. Apart from the aspect of safety, it seems to be cutting down the great deal of time used in previous shaft-sinking efforts to seal off bad areas with the consequent cessation of actual sinking operations. It is estimated that even with the greatest degree of economy, overhead charges on a developing mine are of the order of £100,000 a month, exclusive of expenditure on actual sinking. In consequence, any loss of time is extremely expensive.

F.S. Saaiplaas is using the pre-cementation process. The house reports that "progress is most satisfactory", but mining engineering quarters are suggesting that a new world sinking record may emerge from this Free State mine, and lasting importance would attach to the proof that fast sinking can be achieved in what is undoubtedly most difficult ground.

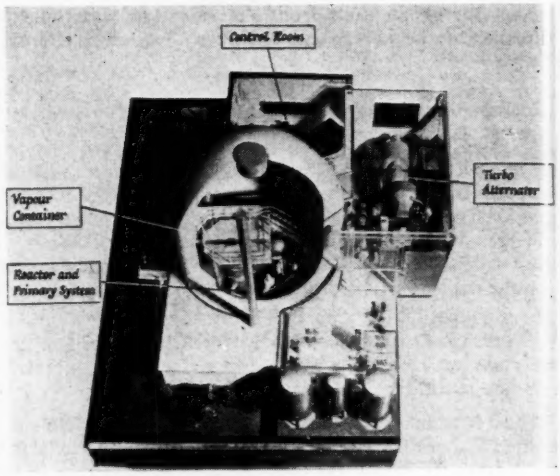
At present, this cementation has only been done to about 1,500 ft. below surface but, on the face of it, the continuation from this level would not seem insurmountable. It is unlikely that possible time lost would exceed that arising from unforeseen cementation work involved under the former sinking methods.

Pre-cementation has finished at the main shaft at Riebeeck and a start has been made on the surface construction work. Here again a further departure from former practice is taking place. It may be recalled that a feature of the opening up at Hartebeestfontein was the acceptance of the idea that, in essence, a headframe is a continuation of the shaft above ground level. At Riebeeck, the approach is that the collar, foundations and headframe are all part of the shaft. Using this, the plan being carried out is that all these will be one piece of concrete which will be poured in one continuous flow.

Actual full-scale sinking will not be started for some time yet, as experience in past years has shown that it is better to operate on a continuous sinking schedule using permanent hoisting equipment and headframes rather than put up temporary headgears and winders. Considerable modifications to the cactus grabs have been made, and it is expected increased efficiency will be obtained. Hartebeestfontein has started work on a third shaft. The present schedule is to start full-scale sinking around May.

The dewatering of Merriespruit is the major headache facing the technical departments of Anglo-Transvaal. A start has been made using kibbles for baling. Anything up to 3,000,000 galls. a day can be handled and it has distinct advantages in a situation where the water level drops rapidly in the early stages. The main question to be answered before a final plan is worked out, is what is likely to be the rate of inflow of water from the fissure that broke through. The other information which will be needed is what actually happened when the second flooding took place.

In the meantime, there has been a change in the siting of pumps in most of the newer mines. It is understood that the tendency now is to establish pumping stations at various levels, so that if the lower levels go, the bulk of pumping capacity is not lost as well.



Small Atomic

AS indicated in our issue of February 1, Britain's activities in the nuclear field are to be extended in an entirely new direction as a result of an agreement between a British and an American firm, which provides for the manufacture of small atomic power stations in the U.K. and their marketing in territories comprising more than half the world. The firms in question are Humphreys and Glasgow Ltd. and Alco Products Incorporated, of the United States.

Formerly known as the American Locomotive Co., Alco established its atomic energy department in June, 1954, in view of the growing importance of its equipment business in the nuclear field. On December 15, 1954, Alco, bidding against 18 other prominent U.S. companies, was awarded a lump-sum contract by the A.E.C. to build a prototype pressurized water power plant designed so that its components would be transportable by air anywhere in the world. Ground for the 2,000 kW. plant was broken in November, 1955, and the installation is due to begin operation at Fort Belvoir early in 1957. This type of reactor was originally developed by the American government for the Nautilus, which recently completed 50,000 miles successfully on one charge during two years of operation.

Alco has drawn on established technology to develop and refine a basic pressurized water reactor design. It is believed that this reactor can compete with conventional generating stations in many localities and applications in various parts of the world, especially where conventional fuel costs are high.

With outputs ranging from 10 to 20 megawatts of electricity, these small power stations will be capable of supply-

Above: A cutaway model of the Alco Army Package Power Reactor. The plant fits on a tennis court. Opposite: The 14-ton reactor vessel is lowered into the domed vapour container. The Alco Army Package Power Reactor is one of the first small nuclear power plants in the world

in; locations of 20,000 to 40,000 people at a cost of between 1½d. and 2d. per unit of electricity produced.

By the circulation of water under pressure, heat is removed from the reactor. On leaving the reactor this water passes through a steam generator or boiler and is then pumped back to the reactor. Steam generated in the boiler passes to a turbo-alternator set where electrical power is produced.

A 10 mW. station will occupy an area no greater than a lawn tennis court. The value of the installation will be about £2,000,000, inclusive of the cost of hiring enriched uranium fuel from the U.S. Atomic Energy Commission. The charge of enriched uranium, depending on the enrichment (which will be from 4 to 12 per cent), will weigh between ½ a ton and 3½ tons and will last from 18 months to two years. Costs will naturally be governed by the site and the degree of enrichment of the uranium fuel selected.

A major advantage of the nuclear plant is freedom from interruption of the fuel supply by transport difficulties. A year's fuel charge is such a small package that delivery by air is feasible, if necessary. Other features which will appeal to mining companies and other potential customers are the simplicity and safety of the system. The design is conservative and uses simple materials such as steel, steam and water, well known to engineers.

Power Stations

The nuclear control circuits are extremely safe under all operating conditions. The control rods are arranged to drop at 150 per cent of design power or if the reactor period becomes less than three seconds. The action is very rapid; the control rods start to drop in about 60 milliseconds and at an acceleration of 24 ft. per sec. The pressurizer is operated by electrical heaters regulated by a pressurestat. Pressure, temperature and water level in the pressurizer are all recorded in the control room, as are the differential temperatures across the reactor. Operational monitoring is provided at significant points to indicate immediately any abnormal operating conditions which might be hazardous to staff within or beyond control areas.

Both the reactor controls and the turbine and electrical control instruments are housed in the central control room.

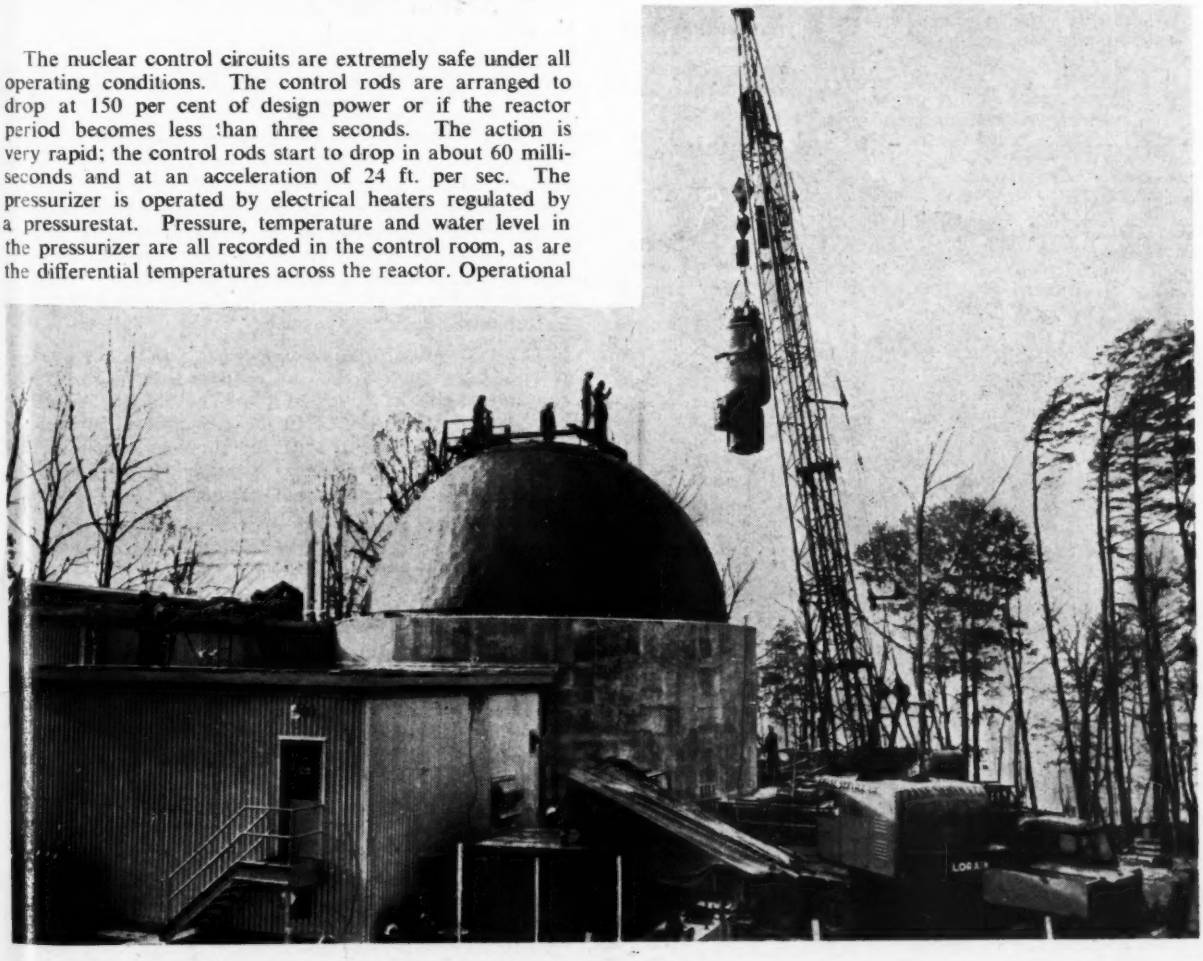
The nuclear energy division of Humphreys and Glasgow will co-operate with Alco in the marketing, engineering and construction of nuclear equipment. The British company has selling rights outside the North American continent and is ready to accept orders at once,

For Mines

with completion time about the same as for conventional plants. Alco is developing other reactor systems, and these will also be marketed outside North America in due course by Humphreys and Glasgow.

Admiral Leggett stated in London that by undertaking as much as possible of the constructional work in the U.K. instead of the U.S., it was hoped that the cost of building reactors and ancillary plant could be considerably reduced.

Since nearly all plant and equipment for orders taken by the British company wil be procured in the U.K., the export content of an overseas contract will be very large and the dollar payment quite small.



New Uses for Tin in Nuclear Power

THE most important use for tin so far developed in atomic power is in alloy with zirconium for water-cooled nuclear reactors.

When the use of zirconium for this application was first studied, the author of the booklet states, that metal's corrosion resistance was found to be highly sensitive to impurities. Certain impurities—such as nitrogen—in the quantity of a few parts per million caused complete disintegration within a day as contrasted with years of life in high-temperature water.

To correct this, experiments were made with a number of other metals alloyed with zirconium. Many were of no use because their capacity for capturing neutrons was so great that not enough were left to carry on the nuclear chain reaction. Other elements were found to destroy zirconium's resistance to corrosion.

Tin, on the other hand, was discovered to have important advantages. Tin does not absorb many neutrons. It counteracts the harmful effect on zirconium of some of the impurities. It promotes adhesion of the corrosion product. And only 1 per cent or 2 per cent is needed.

With the addition of small amounts of iron, nickel and chromium, this tin-zirconium alloy has the desirable properties of excellent corrosion resistance in high-temperature water—improved strength—sufficient ductility for fabrication—and little loss in neutron absorption.

One of the important reasons for the production of this new booklet is to make clear to industry in the United States that there is no shortage of tin, and that supplies are as dependable as those of other metals.

Recognizing the strategic importance of tin, the author states, the United States government has stockpiled enough to meet military needs for 6 to 10 years in any wartime emergency and thus has made current and future tin production available for industrial use.

The significant facts about Malaya's tin reserves are that less than 2 per cent of the Federation's area is alienated for mining and that more efficient methods of tin ore recovery are increasing the yield from lower-grade deposits.

The first of what may become many more uses for tin in nuclear power is described by The Malayan Tin Bureau, of Washington, United States, in the booklet "Straits Tin—Its New Importance to American Industry". This booklet, which was discussed in "Tin", issue of February, 1957, presents the facts about the supply of tin, the properties that make it so useful, and the many ways whereby tin helps to make better products while reducing costs.

The U.S. Atomic Energy Commission's Homogeneous Reactor Experiment No. 2 being loaded for shipment to the Oak Ridge National Laboratory. The core vessel of the reactor was fabricated entirely of the new tin-zirconium alloy

Much has been said about Malaya's vulnerability to Communist aggression, but not enough about the Federation's success in combating Communist terrorism and subversion. United States territory, very much nearer Communist territory than is Malaya, is a much closer target for Communist attack.

The Federation of Malaya is scheduled to obtain complete self-government and independence within the British Commonwealth in August, 1957. The elected Federation government, keenly aware of the economic importance of tin mining, has declared its intention to encourage the development of the industry. Already it has provided tax exemption for expenditure on prospecting.

The booklet sets out the many reasons why tin is so useful in various applications and lists its properties in metallurgical and chemical forms.

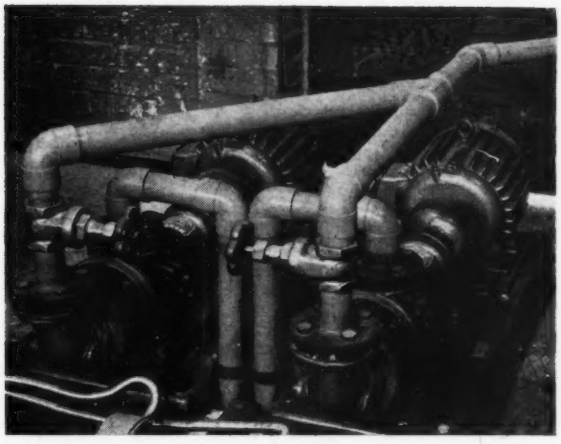
Separate sections deal with the uses of tin in all the most important branches of industry in the United States and particularly with the newest applications.

In the section dealing with the use of tin in the aircraft industry the author lists over sixty parts of the modern aircraft in which tin is used in one form or another.

The Malayan Tin Bureau in Washington, which produced the booklet, is sponsored and financed by the tin producers of Malaya to provide accurate information about Straits tin, and to promote a better understanding between the United States, the world's largest consumer of tin, and Malaya, the world's largest producer. This new booklet, which is attractively illustrated, will do much to assist these aims.

Machinery and Equipment

Control Exciters in Ward-Leonard Mine System



As part of the extensive programme for modernizing the coal industry in this country, the National Coal Board placed contracts with The General Electric Co. Ltd. for the supply and erection of two geared Ward-Leonard d.c. winders for Silverwood and Cadeby Collieries in the North-Eastern Division. The mechanical parts were built at the company's Erith Works and the motors with all the associated control gear were designed and manufactured at the Witton Engineering Works.

These installations are of particular interest in that they represent the first application to d.c. winders of the new G.E.C. system of speed control embodying control exciters, which have been used with marked success for various drives in steelworks, notably those of the temper mills at the Trostre and Velindre Works of the Steel Co. of Wales. Although the winder at the East Shaft of Silverwood Colliery is described, the information applies equally to the equipment in service at No. 2 shaft of Cadeby Colliery.

The winder is designed to raise 525 tons of coal per hour from a depth of 2,299 ft. and is driven through single-reduction double-helical gearing by a d.c. motor rated at 3,700 h.p., 0/320 r.p.m. The 0/650 v. d.c. supply is provided by a 2,650 kW. Ward-Leonard set, of which the 11 kV. synchronous driving motor is started by the reactor method.

There are two parallel drums, 18 ft. dia., one of which is clutched and the other fixed on the drum shaft. An interesting feature is the method of rope grooving employed, whereby the rope is laid across the drum during coiling on the first layer. This grooving is designed to eliminate the undesirable effect of "rope flap", as experienced with the normal series of parallel grooves which have hitherto been employed for multi-layer coiling. The mechanical brakes operate on a variable-pressure principle.

Speed control of the winder is achieved by the control exciter system which combines the most desirable features of the "three-field" generator with those of the straight Ward-Leonard arrangement. The control exciter system differs fundamentally from earlier methods of control in that a definite transition is made from an open-loop to a closed-loop system in which a controlling input signal proportional to the required speed is compared with a signal proportional to the quantity actually obtained from the system output.

In view of the size of the winder motor and the degree of amplification required, two control exciters are installed and are connected in cascade.

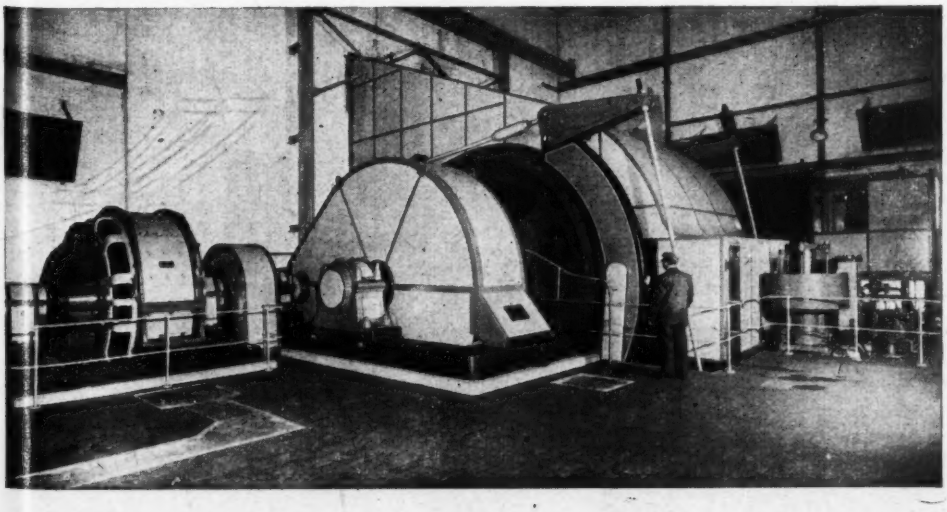
ARE PIPE THREADS OBSOLETE?

In recent years, the welding of joints in steel pipes has become customary for chemical and oil industry installations; this method has largely displaced flanges in the marine field, whilst on copper pipes in certain applications the compression joint is almost universal.

The development of corrosion-resistant pipework in new, strong and light thermoplastics has now, however, brought in train even simpler jointing methods, so that a paint brush or a blending iron can replace the conventional stock and dies or the welding torch, while threading is receding even further into the background.

Developed in the new West Drayton factory of Richard E. DuPont Ltd., for use with the wide range of pipes and fittings sold under the registered trade name of Durapipe, this method of jointing will possibly find favour with engineers and architects for many applications. The jointing process is extremely simple and no special training or equipment is required since the solvent welding compound is applied with a paint brush to the end of the pipe and the inside of the fitting, the pipe is inserted, turned once or twice (or driven home with the larger sizes). The connection is then complete.

Another important new material, Ziegler polythene, is also being used by Richard E. Du Pont Ltd. to make pipes and fittings and is termed Durapipe Z. Here a simple and effective jointing method has been developed which gets over the well known difficulty that there is no common solvent for polythene and that the waxy surface of this material does not encourage the use of adhesives. Dr. Röttner of the German Hoechst Chemical Co. who manufacture Ziegler polythene, discovered that if the oxidized surface could be removed, polythene would adhere to polythene and this has resulted in the evolution of a simple and effective jointing technique. The surfaces to be jointed are heated to melting point, the oxidized layers removed and the surfaces then blended together.



Above, a pump installation made of Durapipe, and below, the 3,700 h.p. geared D.C. winder at Silverwood

MINING MISCELLANY

Extensive deposits of high-grade china clay, containing reserves of about 150,000,000 tons, have been located in Carabobo State, Venezuela. They are shortly to be exploited for export.

*

The territorial Assembly of French Guinea has approved a 25-year plan to provide tax relief to companies which ship materials to develop an alumina industry in this region of French Equatorial Africa.

*

The National Industrial Development Corporation, which is sponsored by the Indian Government, is to erect an aluminium plant at Mattur in Madras State with an annual capacity of 10,000 tons. The establishment of an aluminium plant of a similar capacity at Hirakud has already been sanctioned. Planning of an aluminium plant in the Riband area in Uttar Pradesh has also been started.

*

The Japanese Coal Miners' Union will hold one-hour daily sit-down strikes from February 20 in order to draw attention to its claim for higher wages. The Union, which demanded a 2,000 yen monthly increase, recently rejected an offer by seven major coal mine operators of an increase of 500 yen. The strike is expected to reduce production by 20 p.c.

*

British Petroleum is to conduct a seismic survey in an area near York as part of its search for new sources of oil in the U.K. The area concerned is in a triangle bounded by York, Easingwold and Boroughbridge, where a reconnaissance was carried out in 1945. British Petroleum is also at work in Yorkshire on exploration for natural gas, and in association with I.C.I. is drilling at Robin Hood's Bay.

*

A team of eight British experts left Rangoon recently to start an aerial mineral survey of the Victoria Point area in Burma. This district lies south of Mergui, which is 350 miles S.E. of Rangoon. The survey is to be carried out in specially equipped aircraft as part of an aid programme by Britain under the Colombo Plan Technical Co-operation Scheme.

*

A new chrome deposit has been discovered in the southern part of the Belingwe Reserve, 40 miles south of Shabani. This is an entirely new locality from the previously known deposit. Trenching is now in progress and appearances are very encouraging. A favourable feature is that the Bannockburn-Lourenço Marques Railways is only 20 miles distant.

*

Quebec Government Bills to be introduced during the present session of Parliament will include one dealing with an investment of $400,000,000 in an iron ore mining project south-west of Ungava Bay by the Oceanic Iron Ore Co., (a subsidiary of Rio Tinto Mining Co., of Canada). Another Bill will be concerned with the planned development by Atlantic Iron Ore, a company controlled by Mr. Cyrus Eaton, the U.S. industrialist and banker, which proposes to spend some $200,000,000 on "all kinds of work" in north-west Ungava, in the region of the Payne River. Mr. W. M. Cottingham, Mines Minister, estimates that Quebec's new mining projects will cost around $1,000,000,000 during the next two years.

*

An international syndicate has been set up at Brussels under the name of "Aluminga" to study the possibilities of building an electrolytic aluminium plant in the Belgian Congo, near the mouth of the Congo River at Inga. The Syndicat Belge de l'Aluminium took the initiative in this venture and has been joined by Péchiney and Ugine of France, Société pour l'Industrie de l'Aluminium of Switzerland, Montecatini of Italy, Vereinigite Aluminium Werke of West Germany, Aluminium Ltd., of Canada, and Reynolds Metals of the U.S.

*

The rich new nickel discoveries of Le Moyne Ungava Mines have set the stage for what promises to be one of the biggest, most intensive and most expansive exploration efforts in the history of Canadian mining. According to *The Northern Miner*, there are believed to be as many as 36 companies which have already made determined bids for concessions or interests in this bleak area of New Quebec. It is understood that applications for concessions cover virtually the entire belt of favourable rocks stretching 200 miles from Cape Smith at the north-east tip of Hudson Bay to Wakeham Bay on Hudson Strait.

*

The Japanese Ministry of Trade has asked for foreign exchange to authorise emergency imports of 300,000 tons of coal and 400,000 kilolitres of heavy oil. The imports are needed to relieve the growing shortage of industrial power in Japan. This shortage has arisen through increasing industrial activity and a decline in generating power because of recent drought conditions. The Ministry has announced that the new allocations would increase emergency imports of coal and heavy oil in the six months ending March to 350,000 tons and 1,150,000 kilolitres respectively. It was hoped that most of the imports would arrive by the end of March.

*

Considerable power may be required by the Mbeya Exploration Company Limited in the exploitation of their enormous pyrochlore deposits at Panda Hill. This company, a subsidiary of the Billiton Maatschappij, with the Colonial Development Corporation as partners, have now entered Stage II of their programme, and are erecting a 150 ton-a-day pilot mill. The mine lies some 45 miles from the Kiwara-Songwe coalfield which is situate in the mountains, close to the extreme north-east corner of Lake Nyasa. The C.D.C. are now investigating this field. Drilling has started and it seems probable that ample coal will be found here for power generation, for a small local demand, and possibly for a larger market in Nyasaland. A very small, privately-owned coal mine is already producing in this area.

*

Milling and Smelting the Sudbury Nickel Ores, the second film in the series produced by the International Nickel Company of Canada Ltd., dealing with the nickel industry, was publicly shown for the first time in the U.K. on February 7 at the Mond Nickel Company Ltd.'s head office. Filmed on location at Copper Cliff and other company plants in the Sudbury area of Ontario, the 54-minute film depicts the intricate processes by which nickel—and 13 other elements—are extracted from the Sudbury ores.

PERSONAL

Mr. G. V. White has joined the board of Western Holdings, Ltd. Mr. J. R. A. Bailey has left the board.

*

Following recent Cabinet changes, Lord Hailsham, who succeeds Sir David Eccles as Minister of Education, will now open the Sixth Electrical Engineers' Exhibition at Earls Court on Tuesday, April 9, 1957.

*

The Stockton Forge Division of Head Wrightson has become a wholly-owned subsidiary of the parent company with the title of Head Wrightson Stockton Forge Ltd.

*

An International Mineral Dressing Congress will be held in Stockholm from September 18 to 21. Technical sessions will be held at the Royal Institute of Technology. About 24 papers will be presented and from September 22 to 26 excursions have been arranged to mining districts in North and Central Sweden, Norway and Finland.

CONTRACTS AND TENDERS

South Africa

The International Co-operation Administration (I.C.A.) has announced the following procurement for South Africa: Two water lubricated turbine pumps, two 7 b.h.p. diesel engines with engine pulleys and slide rails, V-belts, all in accordance with specification No. 3874. Issuing authority South African Railways. Closing date 27/2/57. B.O.T. ref.: E.S.B. 3203/57. Telephone enquiries to Chancery 4411, Extension 738 or 771.

*

English Electric of Canada, wholly-owned subsidiary of John Inglis Co., which in turn is controlled by English Electric, has been awarded a contract by Aluminium of Canada for the production and installation of five turbines each of 200,000 h.p. for Alcan's $150,000,000 power development at Chute des Passes, on the Peribonka River, Northern Quebec. The units are the largest ever to be made in Canada, and the five units together are reported to constitute the biggest turbine order ever given in Canada.

Metals and Minerals

Diamonds Without Mink

Diamonds, with their emotional, financial and industrial appeal are part mink, part sphinx, and part cog in any nation's make-up. And for these very good reasons they have a news value as great as or greater than almost any other known substance.

This can, of course, be an advantage both to the producers and to the distributors when the course of true demand is running smooth. But when something happens to affect their supply position in general and their appeal and usefulness in particular, publicity is apt to mistake the mouse for the elephant.

A year or so ago, General Electric Company announced amidst a fanfare of trumpets their achievement of "man-made diamonds". As usual following such declarations, the diamond market rocked to its foundations and rolled on the floors of the world's stock exchanges. However, when the smoke of battle cleared the trumpets were muted and the world settled down to its grim task of having to get along with the "conventional stones". Earlier this year diamonds were subjected to the chilling announcement from Russia that a new field had been discovered in the Urals which, by implication, would soon make diamonds as plentiful as peas. But this too passed.

This week there has been another announcement from General Electric stating that members of the same research team which discovered synthetic diamonds had produced a new material which they have called "Borazon" having as its outstanding attributes a hardness, and a resistance to heat, far greater than for diamonds.

The agency message describing the new substance says that its creation started with boron nitride, commonly called "white graphite" and similar in appearance and texture to talcum powder. Using pressures above 1,000,000 lbs. to the square inch, the crystals' structure was changed from hexagonal, like graphite, to cubic, like a diamond. Such a cubic crystal of boron nitride is unknown in nature and is strikingly similar to that of a diamond although it is not a diamond: diamond burns up at 1,500 deg. and borazon can withstand 3,500 deg.

G.E.C. believe borazon's resistance to oxidation will make possible superior methods of mounting stones in industrial tools and also may allow bits and wheels to be operated at higher speeds, performing their cutting and polishing jobs more quickly and efficiently. This is claimed as the forerunner of other products.

Reaction from Johannesburg, while not decrying the possible importance of borazon, emphasises that the substance offers no apparent threat to gem diamonds, and while suggesting that, though production costs are unknown, they are unlikely to enable borazon to compete with industrial diamonds. In addition, Johannesburg points out that the reported special qualities of borazon offer a potential of its use in new fields where it would be uncompetitive with industrial diamonds. Johannesburg's lack of fears seem to carry some weight, as both gem and industrial diamonds are reported to be meeting very good demand at recently higher prices.

However, it is well-known that the United States is the main buyer of industrial diamonds, largely for strategic stockpiling. Hence there is a possibility that the discovery of a method of making borazon, as well as man-made diamonds, could eventually bring some diminution to the United States offtake of industrial diamonds.

Higher-priced diamond shares on the Johannesburg Stock Exchange, for which there is comparatively no local interest, have been easing recently for various reasons and the borazon announcement had little discernible effect.

Quite obviously it is as dangerous to cry "diamonds" too often as it is to cry "wolf".

BERYLLIUM AND TITANIUM PRICES LOWER

Reports from both sides of the Atlantic reveal reductions in the prices of beryllium copper alloy in the United States and of titanium in Britain.

In New York, Penn Precision Products Co. announced last week that base prices of beryllium copper alloys have been reduced 2c. per lb. The new price ruling is effective with shipments of February 6. The base prices thus stand at between $1.59 to $1.80 for four grades of alloys. Purchase prices for beryllium copper scrap have also been reduced, as from February 6. Similarly the base prices on phosphor bronze, nickel silver and chromium copper strip have been reduced in accordance with their copper content.

In the U.K. I.C.I. has announced that its prices for wrought titanium and titanium alloy products in general have been reduced by 10 per cent. Prices will continue to vary, however, according to the form of the wrought product and the grade of alloy used.

Factors contributing to the reduced prices are titanium's expanding range of applications in the aircraft industry and the continuing decline in the price of I.C.I. raw titanium metal, now selling at 19s. 6d. per lb., the lowest published price in the world.

FREE NICKEL MARKET

The general pattern of the free nickel market has not altered materially. Available supplies are still fetching enhanced prices on the Continent of well over £2,000 per ton. There is still no news of the price at which Japan would offer for new business. It is said that not only is Japan still committed for some time ahead, but she is also still in the process of finalising arrangements for fresh ore supplies. In the U.K. pure nickel scrap continues in very tight supply, with prices, if anything, tending higher. For normal commercial lots a price of around £1,300 per ton, or even more, is mentioned.

★

It has been reported that Rhodesian Vanadium Corporation—a subsidiary of Vanadium Corporation of America—is to develop the nickel deposit discovered recently at Bindura (*The Mining Journal*, 25/1/57, p. 117). Trenching work is now under way, according to one of the two partners with an interest in the deposits. The two partners have claims extending for eight miles and exclusive prospecting rights over 10 square miles in the area.

★

Plans for a large-scale ferro-nickel industry in the Philippines derived substantial encouragement from President Ramon Magsaysay's message to Congress, in which he recommended opening the large nickel-iron deposits in the Government reservation in Nonoc Island, Surigao Province, to private mining companies. Mining experts consider that the Philippines have a ferro-nickel production potential of 1,000,000 tons. Should Congress act on the President's recommendation and pass appropriate legislation to open up the Monoc reserves this year, it would be 1962 before the industry could be expected to start producing dollars.

The possibility of establishing a ferro-nickel industry is enhanced by the large potential low-cost power now being made available through the construction of new hydro-electric plants in the northern and southern Philippine islands.

MAGNESIUM'S NEW RECORDS

Approximately half the total world output of magnesium is produced in the U.S. A further indication of the expanding market for this light metal is afforded by new peacetime records for the U.S. in both shipment and production, which were reported by the Magnesium Association. In spite of severely curtailed production for July and August, the magnesium industry's 1956 production increased by 12 per cent over 1955, while wrought products shipments, less affected by the work stoppage, registered a gain of 20 per cent from the previous year.

ZIRCONIUM PRODUCTS IN DEMAND

The Niagara Falls plant of National Lead Co.'s Titanium Alloy Manufacturing Division is to undergo a major expansion of its manufacturing facilities. The project is scheduled for completion by July 1, 1957. The expansion is necessary to satisfy the increased demand for zirconium oxide and zirconium silicates, which are used in the manufacture of wall tiles, ceramic ware, porcelain and enamelled goods, glass polishing and refractories.

Titanium Alloy has produced zirconium metal since 1932 for corrosion-resistant applications in tank linings, valves and tubing, as well as in powder form

for absorbing gases in vacuum tubes and for hastening the combustion of flash powders and explosives. A specialized form of the metal is used in atomic reactors.

ILMENITE AND RUTILE

U.S. production of ilmenite in 1956 is estimated by the Bureau of Mines to have risen 5 per cent over 1955 to about 610,000 s.tons, while ilmenite held near the 1955 level. However, a rising demand and high prices raised domestic output of rutile—at present the only source of titanium metal—by 40 per cent to about 12,000 tons. Imports in the first nine months were 160 per cent greater than in the comparable 1955 period, establishing a record of 37,458 s.tons. As rutile became more readily available, quoted prices for rutile concentrate (94 per cent titanium dioxide) dropped gradually from a high of 10 to 15 c. per lb. to the range of 10 to 13½ c.

★

In London, Australian rutile prices are continuing to drift lower under lack of buying interest. The market is said to be largely nominal at the present time.

COPPER · TIN · LEAD · ZINC

STOCKPILING COPPER

Our Metal Exchange Correspondent draws attention this week to the considerable absorptive power of the various U.S. domestic price support contracts with copper producers, and suggests that the amount of copper which would find its way into the stockpile on these contracts with copper at 30 c., might more than absorb current excess production which, on a world basis, is now reported to be running at some 15,000 tons a month. Although it may be somewhat optimistic to look to Washington to mop up 180,000 tons a year at 30 c., it is certainly true that in the post-Korean period floor priced contracts, at levels ranging from 32 c. down to 24½ c., were placed by the U.S. government, which in the aggregate must now be producing an output of around 250,000 tons.

Meanwhile, the domestic producers are continuing to hold their price at 34 c., although there have been hints this week that at any rate one custom smelter has been selling below the 33 c. level. Export business has been around 31½ c.

At the end of last year world producers' stocks stood at 353,000 tons, as compared with the 400,000 ton level which obtained at the beginning of 1954, just prior to the U.S. government taking 100,000 tons of Chilean stocks into the stockpile, and it now seems almost inevitable that further production cut-backs must soon come in the U.S. domestic industry, more especially as other countries show no signs of putting on the brakes. Thus, the Chilean government Copper Department estimated last week that Chilean output in 1957 would reach 550,000 tons compared with 440,000 last year. Equally, there are no signs of output on the Copperbelt being retarded, although both here and in Chile the loss of output from strikes is always an unpredictable factor.

At a recent address in New York for members of the A.M.I.E., Sir Ronald Prain had some interesting comments on the relative level of Rhodesian production costs. After pointing out that during 1955 the average cost on the Copperbelt was over 19 c. per lb. of electro compared with about 18½ c. for the average of all U.S. domestic copper production, he went on to say that, on the basis of data available for about five-sixths of all Free World Production in 1955, it had been found that 52 per cent was produced at a cost less than on the Copperbelt and 32 per cent at a cost above. He continued "assuming that the price fell to a point where the Copperbelt were to go to a break-even basis, then I calculate that 38 per cent of the same tonnage of world copper would still be produced more cheaply and 46 per cent would be produced at a higher cost". Both these sets of calculations credit the Copperbelt with 16 per cent of world production.

STRIKEBOUND TIN

With the onset yesterday of the dock strike along the American Atlantic seaboard, superimposed on the continuation of the strike at the Straits Trading Company's Butterworth smelter (now some five weeks' old) it is not surprising that the New York quotation for spot tin has gone nominal at 102¼ c. If this strike persists, we may well see an extremely tight spot position developing in the States, side by side with a considerable easing in the market in London as the Liverpool smelter steps up its output now that the bulk of the concentrates formerly going to the Texas smelter are finding their way there.

In Malaya, leading European tin producers are reported to have announced their intention to maintain the fullest possible production during 1957, despite the expectation of lower prices. They point out that production on the European properties in Malaya is based on a long-term policy of maintaining production and opening up new deposits.

LEAD BUYING SATISFACTORY

Output of refined lead in the U.S. in 1956 rose sharply to 613,293 tons from 547,153 tons in 1955; this was the biggest output since 1942 when 633,818 tons were produced. Total U.S. stocks at smelters and refiners (including metal refined and in ore) stood at 159,259 tons at December 31 last, compared with 150,822 tons a year earlier.

In a recent speech before the National Western Mining Conference, Mr. Felix Wormser, Assistant Secretary to the Interior, said that the administration would continue the barter of surplus farm commodities for metals through to mid-1958.

In New York, buying of lead for February shipment is reported satisfactory at 16 c.

ZINC STOCKS RISING

U.S. mine production in 1956 is provisionally estimated at about 530,000 s.tons, that is to say, 5 per cent up on the previous year. U.S. slab zinc output (from domestic and foreign ores) reached the all-time high of 1,062,594 s.tons, a 3 per cent rise over the previous record of 1955. Slab zinc shipments in 1956 totaled 1,035,301 s.tons, a decrease of about 9 per cent on 1955. Of this total, galvanizers took 429,000 s.tons, die-casters about 360,000 s.tons and brass mills about 121,000 s.tons.

Stocks during the year rose by nearly 40,000 tons which helps to explain the lower consumption figures for the past year (relative to shipments) which are reported at 388,000 s.tons by galvanizers, 319,000 s.tons by die casters and 114,000 s.tons by brass mills.

Zinc purchases in the States continue to be on a hand to mouth basis. Galvanizers' requirements are reported to be tapering off and, die casting remains adversely affected by the slow progress of the car industry. The difficulties of the car industry are, of course, by no means confined to the States and it is just a question of whether Washington's barter transactions and limited domestic buying for the stockpile will see the zinc price steady through this present difficult phase.

The London Metal Market

(From Our L.M.E. Correspondent)

Although the general downward trend in metal prices continues, the pace has slackened and one hears more talk about a turn being in sight, but it must be admitted that at the moment such expectations are based more on "market feeling" than on any tangible evidence.

In the copper market there are very few signs of increased consumer activity, but rumours of U.S. government intervention or cut-backs by producers are more frequent, and it is believed that there is now a fair amount of buying power held in reserve to be used as soon as the slide in price appears to be checked. Whatever happens it must be remembered that the U.S. government has extensive commitments to take in metal from domestically-mined ores at various "floor" prices, and some quarters believe that should a level of 30 c. be reached this off-take would more than balance the production/consumption equation.

The turnover in the tin market has been increasing and the backwardation shows signs of narrowing on freer offerings of tin, presumably resulting from the intake of ore which previously went to the Texas smelter. It would not be surprising to see a fairly sharp drop in the metal if the strike in Penang were settled and resumption of shipping through the Suez Canal became likely within a few months. On Thursday morning the Eastern price was equivalent to £775¼ per ton c.i.f. Europe.

There have been no features in the lead and zinc markets although there has been a continuing tendency for the backwardations to narrow. Consumption generally remains satisfactory, and there is no real evidence that the U.S. government will either cease to buy monthly tonnages or to discontinue the barter programme. It must be remembered that it is this latter programme which has the most immediate influence on the London market, and that the prices which can be paid probably depend more upon the price obtainable for the surplus farm produce than on anything in the metal situation.

Closing prices and turnovers are given in the table overleaf.

LONDON METAL AND ORE PRICES, FEBRUARY 14, 1957

THE WEEK ON THE L.M.E.

	February 7 Buyers	February 7 Sellers	February 14 Buyers	February 14 Sellers
COPPER				
Cash	£248½	£249	£250	£251
Three months	£247½	£248	£248	£248½
Settlement	£249		£251	
Week's turnover	7,875 tons		6,375 tons	
LEAD				
Current ½ month	£113½	£113¾	£113¾	£114
Three months	£112¾	£113	£113	£113¼
Week's turnover	2,725 tons		3,475 tons	
TIN				
Cash	£779	£780	£771	£772
Three months	£762	£763	£752	£753
Settlement	£780		£772	
Week's turnover	755 tons		1,250 tons	
ZINC				
Current ½ month	£101¾	£102	£100	£100¼
Three months	£98¼	£99	£96¾	£97¼
Week's turnover	2,950 tons		7,650 tons	

METAL PRICES

Aluminium, 99.5%, £197 per ton

Antimony —
English (99%) delivered, 10 cwt. and over £210 per ton
Crude (70%) £200 per ton
Ore (60%) bases 23s. 6d./24s. 6d. nom. per unit, c.i.f.

Arsenic, £400 per ton

Bismuth (min. 1 ton lots) 16s. lb. nom.

Cadmium 12s. 0d. lb.

Cerium (99% nett), £13 18s. lb. delivered U.K.

Chromium, 7s. 2d. lb.

Cobalt, 19s. lb.

ORES AND OXIDES

Bismuth	30% 5s. 0d. lb. c.i.f. 18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable) 48%	£17 8s. 0d. per ton c.i.f.
,, Hard Lumpy (45%)	£17 8s. 0d. per ton c.i.f.
,, Refractory 40%	£12 15s. 0d. per ton c.i.f.
,, Smalls 42%	£16 5s. 0d. per ton c.i.f.
Baluchistan	£18 15s. 0d. per ton c.i.f.
Columbite, 65% combined oxides, high grade	185s./197s. 6d. per unit
Fluorspar—	
Acid Grade, Flotated Material	£22 per ton ex. works
Metallurgical (75/80% CaF_2)	151s. 6d. ex. works
Lithium Ore—	
Petalite min. 3½% Li_2O	£8-£10 per ton f.o.b. Beira
Lepidolite min. 3½% Li_2O	£8-£10 per ton f.o.b. Beira
Amblygonite basis 7% Li_2O	£28-£32 per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£22 0s. d/d
Molybdenite (85% basis)	8s. 5d. nom. per lb. (f.o.b.)
Titanium Ore —	
Rutile 95/97% TiO_2	£75/£77 per ton c.i.f. Aust'n
Ilmenite 52/54% TiO_2	£11 per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	190s./195s. per unit c.i.f.
Manganese Ore Indian	
Europe (46%-48%) basis 155s. freight plus 17½% surcharge	141d.-151d. nom. per unit c.i.f.
Manganese Ore (43%-45%)	116d. nom. per unit. c.i.f.
Manganese Ore (38%-40%)	111d. nom. per unit. (including duty)
Vanadium —	
Fused oxide 90-95% V_2O_5)	£12½-£13½ per unit c.i.f.
Zircon Sand (Australian) (65-66% ZrO_2)	£20 per ton c.i.f.

Germanium, 99.99%, Ge. kilo lots 3s. 4d. per gram

Gold, 249s. 5½d.

Iridium, £27/29 oz. nom.

Lanthanum (98/99%) 15s. per gram

Manganese Metal (96%-98%) £310

Magnesium, 2s. 5½d. lb.

Nickel, 99.5% (home trade) £600 per ton

Osmium, £24/27 oz. nom.

Osmiridium, nom.

Palladium, £8 0s./£8 10s. oz.

Platinum U.K. and Empire Refined £34 oz.
Imported £34½/£35½ nom.

Quicksilver, £84 10s. ex-warehouse

Rhodium, £42 oz.

Ruthenium, £15/£17 oz. nom.

Selenium, 85s. nom. per lb.

Silver, 79¾d. f. oz. spot and 79½ f'd.

Tellurium, 15s./16s. lb.

LONDON STOCK EXCHANGE PRICES, FEBRUARY 13, 1957

Finance	Price Feb. 13	+ or — on week
African & European	57/6	.....
Anglo American Corpn.	6⅛	—1/16
Anglo-French	22/9	.....
Anglo-Transvaal Cons.	27/6	.....
Central Mining (£1 shrs)	52/6	.....
Consolidated G'fields	57/6	—3d
Consol. Mines Selection	33/9	—7½d
East Rand Consols	1/6	.....
General Mining	70/-	.....
H. E. Prop.	8/-	.....
Johnnies	42/3	+6d
Rand Mines	63/9	—1/3
Rand Selection	35/7½	—7½d
Union Corporation	38/3	—3d
Vereeniging Estates	4 3/16 XD	—¼
Writs	36/10½	+7½d
West Wits.	34/3	+9d
Rand Gold		
Blyvoors	20/3	.....
Brakpan	5/7½	.....
Buffelsfontein	33/4½	+3d
City Deep	11/-	.....
Consol. Main Reef	12/3	+3d
Crown	27/6	.....
Daggas	33/1½	—1/3
Dominion Reefs	18/-	.....
Doornfontein	22/9	—3d
Durban Deep	23/1½	—1/3
E. Champs	3/-	.....
E. Daggas	7/9	.....
E. Geduld (4s. units)	27/-	+3d
E. Rand Props.	43/9	.....
Geduld	73/9	.....
Govt. Areas	3/-	+1½d
Grootvlei	16/10½	+3d
Hartebeestfontein	45/1½	—6d
Libanon	6/9	+1½d
Luipaards Vlei	14/-	+6d
Marievale	16/10½	.....
New Kleinfontein	3/-	.....
New Pioneer	17/-	.....
Randfontein	31/6	+1/-
Robinson Deep	6/6	—3d
Rose Deep	7/9	.....
Simmer & Jack	3/9	+1½d
S.A. Lands	22/6	.....
Springs	2/3	.....
Stilfontein	27/9	.....
Sub Nigel	15/7½	—1/4½
Vaal Reefs	32/-	—1½d
Van Dyk	2/4½	+1½d
Ventersdpost	12/-	—1½d
Vlakfontein	14/6	—6d
Vogelstruisbult	12/1½	.....
West Driefontein	5 1/16	.....

Rand Gold contd.	Price Feb. 13	+ or — on week
W. Rand Consolidated	30/7½	—7½d
Western Reefs	30/-	—1½d
O.F.S. Gold		
Freddies	7/-	+9d
Freddies Consolidated	3/4½	+1½d
F.S. Geduld	71/3	—7½d
Geoffries	3/-	.....
Harmony	24/6	—9d
Loraine	4/7½	—1½d
Lydenburg Estates	12/9	—3d
Merriespruit	3/10½	+1½d
Middle Wits	8/-	.....
Ofsits	51/6	+3d
President Brand	53/1½	+1/3
President Steyn	30/6	.....
St. Helena	27/9	—1½d
Virginia Ord.	8/9	.....
Welkom	15/3	—6d
Western Holdings	71/10½	.....
West African Gold		
Amalgamated Banket	1/3½	+½d
Ariston	3/6	+1½d
Ashanti	17/- XD	+1/-
Bibiani	2/3	+3d
Bremang	1/4½	.....
G.C. Main Reef	1/4½	.....
Konongo	1/4½	.....
Marlu	½d	.....
Taquah	1/-	.....
Western Selection	6/4½	.....
Australian Gold		
Gold Mines of Kalgoorlie	13/10½	+1½d
Great Boulder Prop.	12/6	.....
Lake View & Star	18/7½	+3d
Mount Morgan	16/-	—6d
North Kalgurli	7/9	+1½d
Sons of Gwalia	1/9	.....
Western Mining	11/1½	+1½d
Miscellaneous Gold		
Cam & Motor	7/9	—3d
Champion Reef	13/-	.....
Falcon Mines	7/9	.....
Globe & Phoenix	23/3	.....
Motapa	1/1½	—4½d
Mysore	3/3	.....
Nundydroog	18/-	.....
St. John d'el Rey	66/3	+2/6
Zams	50/-	.....

Diamonds and Platinum	Price Feb. 13	+ or — on week
Anglo American Inv.	8⅞	—1/16
Casts.	25/3	—10½d
Cons. Diam. of S.W.A.	10/10½	+3d
De Beers Defd. Regd.	4½	—¼
De Beers Pfd. Regd.	14¼	+⅛
Pots. Platinum	15/6	—3d
Waterval	25/-	—1/-
Copper		
Bancroft	44/6	.....
Chartered	68/- XD	.....
Esperanza	2/9	.....
Messina	8½	.....
Nchanga	11⅛	—⅛
Rhod. Anglo-American	4¾	—3/16
Rhod. Katanga	44/6	—3d
Rhodesian Selection	44/-	.....
Rhokana	37½	—¼
Rio Tinto	4 11/16	+3/16
Roan Antelope	13/1½ XC	—9d
Selection Trust	4 13/16	—1/16
Tanks	7 1/16	+1/16
Tharsis Sulphur Br.	5	.....
Tin (Eastern)		
Ayer Hitam	25/-	+3d
Gopeng	14/9	.....
Hongkong	7/4½	—9d
Ipoh	25/-	—1/-
Kamunting	9/10½ XD	—6d
Kepong Dredging	5/3	—3d
Kinta Tin Mines	24/-	+9d
Malayan Dredging	14/4½	—9d
Pahang	12/9	+4½d
Pengkalen	16/9	—6d
Petaling	7/6	—1½d
Rambutan	18/3 XR C	—3d
Siamese Tin	11/3	—7½d
Southern Kinta	16/4½	.....
S. Malayan	9/7½	—6d
S. Tronoh	6/7½	—3d
Sungei Kinta	19/9	+3d
Tekka Taiping	8/1½	.....
Tronoh	12/9	.....
Tin (Nigerian and Miscellaneous)		
Amalgamated Tin	10/1½	—7½d
Beralt Tin	46/-	.....
Bisichi	4/3	—1½d
British Tin Inv.	21/3 XD	—1/6
Ex-Lands Nigeria	2/3	.....
Geevor Tin	20/7½	+1½d

Tin (Nigerian and Miscellaneous) contd.	Price Feb. 13	+ or — on week
Gold & Base Metal	1/-	—1½d
Jantar Nigeria	2/9	—3d
Jos Tin Area	13/9	—3d
Kaduna Prospectors	1/9	.....
Kaduna Syndicate	2/1½	—1½d
London Tin	10/6	—6d
United Tin	9d	.....
Silver, Lead, Zinc		
Broken Hill South	72/3	+1/6
Burma Mines	3/9	.....
Consol. Zinc	83/6	—6d
Lake George	10/-	—1½d
Mount Isa	30/3	+6d
New Broken Hill	53/9	—2/3
North Broken Hill	6¼	—¼
Rhodesian Broken Hill	13/4½	—1½d
San Francisco Mines	23/6 XD	—10½d
Uruwira	4/-	.....
Miscellaneous Base Metals and Coal		
Amal. Collieries of S.A.	2 3/32	.....
Associated Manganese	37/-	—3/-
Cape Asbestos	10/7½	.....
C.P. Manganese	24/6	+6d
Consol. Murchison	48/1½	+1/10½
Natal Navigation	3¼	.....
Turner & Newall	114/6	+2/-
Wankie	18/9	+1/6
Witbank Colliery	5¼	+1/16
Canadian Mines		
Dome	$25	—1
Hollinger	$46½	—3¼
Hudson Bay Mining	$152	—13
International Nickel	$189½	—7½
Mining Corpn. of Canada	£6½	—¼
Noranda	$96	—4
Quemont	£6⅜	.....
Yukon	4/4½	.....
Oil		
Apex	42/-	+3d
Attock	37/6	.....
British Petroleum	133/6	+1/7½
Burmah	86/6	+2/1½
Canadian Eagle	62/6	+3d
Mexican Eagle	22/-	+1½d
Shell	154/6	—6d
T.P.D.	48/-	+6d
Ultramar	63/3	+1/-

Mining Finance

Luipaards Changes Its Spots

Uranium ore reserves, production and grade statistics released last month by the South African gold-uranium producers have confirmed the previously held contention that the small and separate group of mines lying at the western extremity of the Western Rand contain the richest uranium deposits of all the Union's gold mining fields, including the Rand, Far Western Rand, Orange Free State and Klerksdorp areas.

The outstanding property of this group is Luipaards Vlei whose 640,000 tons of ore reserves contain as much as 2.27 lb. of uranium oxide per ton, thereby exceeding the values of both its neighbours, West Rand Consolidated and Randfontein, by about 1 lb. of ore.

It must be admitted straightaway that Luipaards Vlei's available ore reserves are at present far too small. But as the chairman of the company, Mr. W. M. Barclay has pointed out, the work involved in bringing the mine's uranium bearing Bird Reefs to production is equivalent to opening up a new property. And although development is being pushed ahead very rapidly indeed, some time must be expected to elapse before the full potentialities of the mining area can be assessed. Nevertheless, the company's technical advisers expect that sufficient ore will become available to satisfy the existing contract with the A.E.B. which terminates in some nine years' time.

It is, therefore, the question of ore supplies during the period after the contract ends which remains unanswered. On the other hand, work so far has yielded encouraging results, and there is no reason to suspect that development will not continue satisfactorily.

If all goes well, and the present excellent uranium grade is maintained Luipaards Vlei, having amortized the cost of its treatment plant by 1965, should find itself in a strongly competitive position to meet future commercial markets for uranium.

The position is not so favourable in respect of gold, the production of which has recently encountered severe difficulties. A fall in grade, together with a lower mill throughput have, in fact, reduced earnings to an extremely marginal condition. It is, perhaps, because of this adverse influence more than any other that the company's 2s. share should have fallen from about 18s. during 1956, to the present level of about 14s. 6d. But Luipaards Vlei is in fact a uranium producer recovering gold as a by-product, so that not too much attention should be given to this aspect of the company's operations.

Moreover, the company's uranium plant has not yet reached its full rated capacity of 50,000 tons a month. During the three months ended December 31, 1956, a total of 136,000 tons of uranium-bearing ore were leached in the plant, leaving scope for a further 14,000 tons a quarter or an additional 56,000 tons yearly. And the attainment of this figure, while being dependent upon the progress of development operations, should not now be long delayed.

It may have been this factor which led Mr. Barclay to state last November that profits for the year ended June 30, 1957, were expected to show an increase. In 1955-56, Luipaards Vlei paid dividends amounting to 1s. 4½d. per share compared with 1s. 3d. in the previous year. Moreover, the first payment on account of 1956-57 has been raised to 10½d. from the previous corresponding level of 7½d.

Although a sharp reduction in amortization allowances arising from past uranium capital expenditure will mean that the company must in future face substantial taxation payments annually, the 1955-56 dividend costing £340,000 came from net profits of £784,000. There is, then, every likelihood of an increased distribution this year.

At their present price of 14s. 6d. Luipaards Vlei 2s. shares yield about 11 per cent and it must remain a matter of individual assessment as to whether this return discounts sufficiently the risk which lies in Bird Reef development continuing to show its present high uranium values. Meanwhile, it might be pointed out that if dividends average 1s. 6d., over the remaining nine years of the A.E.B. contract, the present worth of such a distribution, calculated on a yield basis of 8 per cent and after making allowance for amortization, would be something like 9s. per share. Of the remaining 5s. 6d., some 2s. is covered by net liquid assets, which leaves only 3s. 6d. to represent the company's potential dividend paying capacity after 1965.

RHO-KATS LIVING AT DEPTH

A six months' progress report covering the period June 30 to December 31, 1956, published by Rhodesia-Katanga on behalf of the Kansanshi Copper Mining Company in Northern Rhodesia, of which it holds some 35¼ per cent, has revealed that although difficulties have so far prevented initial production targets being attained this promising property continues to open up well.

The Anglo American Corporation of South Africa are acting as consulting engineers to Kansanshi, and on their recommendation a plant has been erected at which it is planned to treat sufficient monthly quantities of ore to finance the exploration of the good-grade sulphide copper deposits proved by boreholes to exist in vein formations at depth.

In the latter part of 1956 it was estimated that when production started, output would be able to build up without marked delay to 3,000 tons of some 12 per cent oxide ore together with 12,000 tons of 3.5 per cent sulphide ore. It was arranged to send oxide ore to Nkana for direct smelting, while the sulphide was to be concentrated at the mine prior to final treatment, also at Nkana. Unfortunately, it has not yet been possible to achieve these estimates, and during the period, November 7 to December 31, 1956, sulphide ore milled totalled only 9,690 dry s.tons although its grade at 3.75 per cent copper was higher than had been expected. Oxide ore production totalled 2,016 s.tons during the same period, but the grade averaged only eight per cent copper. Oxide mining thus had to be suspended during November and will not be resumed until higher grade ore can be drawn from one of the mine's dolomite ore-bodies to which development is now being directed.

Meanwhile, opening-up work at the mine has continued apace. Perhaps the most interesting disclosures were those of four well-mineralized sulphide veins on the 290 ft. level striking roughly east and west lying between the Main South area and Main North Shaft workings. Sampling results obtained from these were extremely good and the best gave an average assay of 12.3 per cent copper over 32 inches. Yet, the importance of this discovery lies more in the clue it provides as to geological dispositions at the mine rather than the copper content obtained. Originally it was assumed that the veins at Kansanshi ran in a north to south direction, and the disclosure of a system lying east to west holds the

RECENT INTERIM DIVIDEND ANNOUNCEMENTS

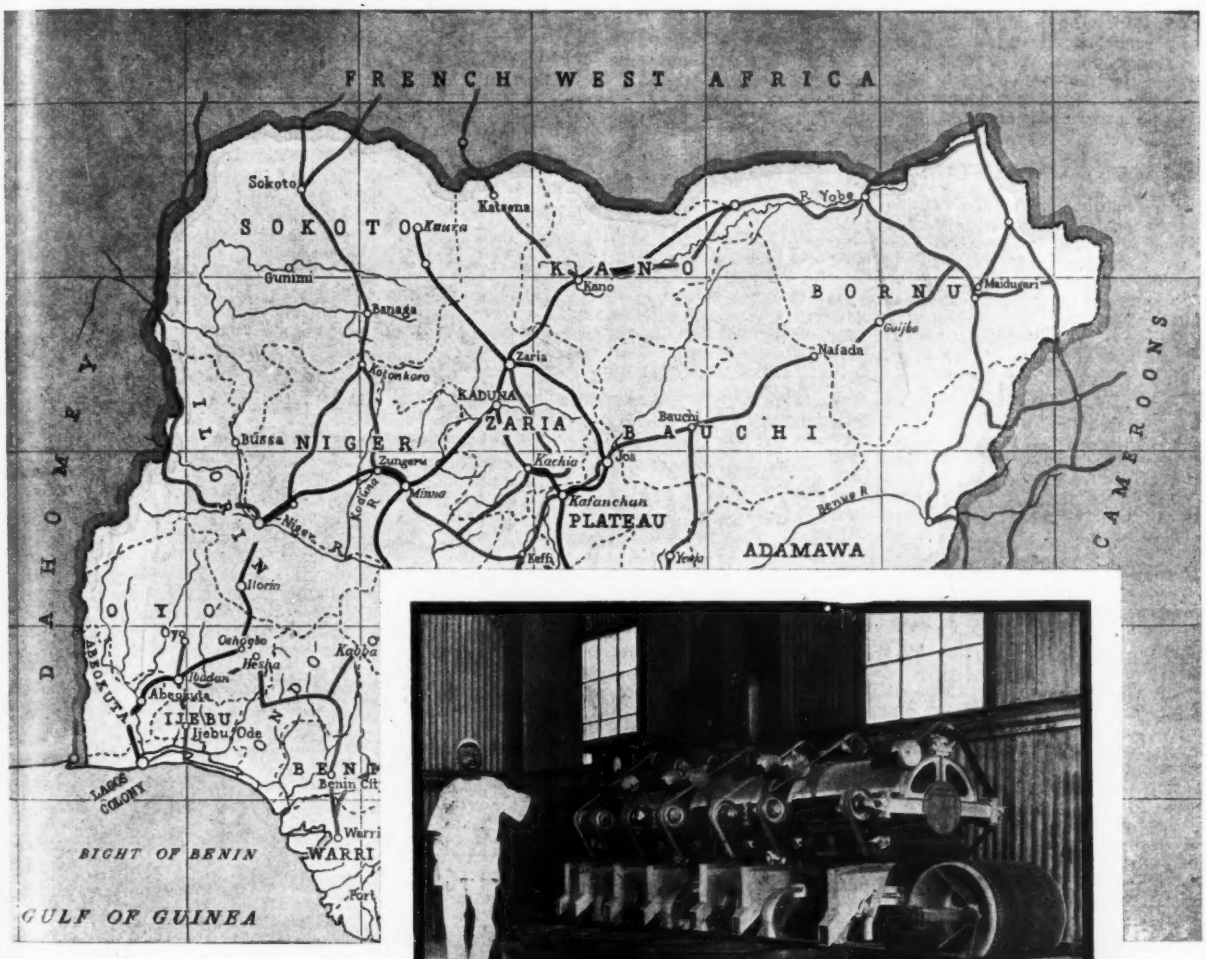
Company	Year Ending	Dividends Latest	Dividends Corresponding	Date Payable	Total Last Year
		%	%		%
Mount Morgan	30. 6.57	10	10	March 30	20
Indian Copper (*a*)	31.12.56	6¾	10	Feb. 22	45
Ariston Gold	30. 9.57	5	Nil	Feb. 12	5
Fanti Cons. (*b*)	31.12.56	12½	12½	—	12½

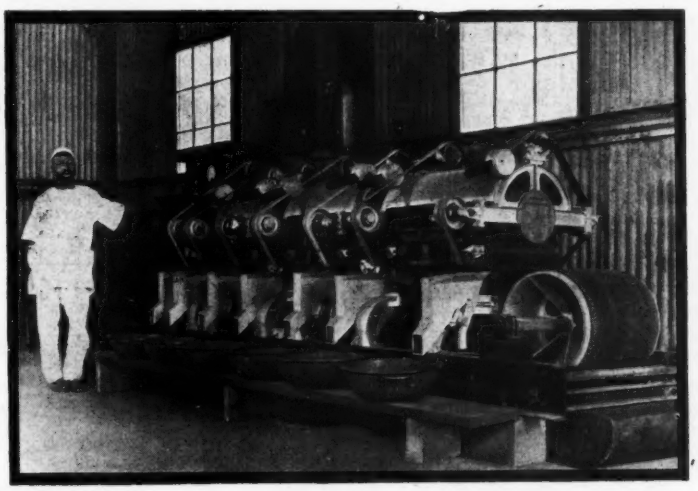
(*a*) Dividends free of Indian income tax. Latest paid on increased capital after 50% scrip issue.
(*b*) Includes 5% bonus (same).

RECENT FINAL DIVIDENDS AND PRELIMINARY FIGURES

Company	Year Ended	Final Dividend	Net Profit after tax This	Net Profit after tax Last	Total Dividends This	Total Dividends Last
		%	£(000)	£(000)	%	%
San Francisco Mines	30. 9.56	32½	609	489	45	40
Ariston Gold	30. 9.56	5	29	206	5	10
Vereeniging Estates	31.12.56	20	1,044	983	32½	32½

Magnetic separation of columbite in NIGERIA





Huntington Heberlein high intensity magnetic separators are being used by Nigeria's major producers of columbite, to separate this important raw material from which columbium, aptly described as the "rarest jet metal" is derived.

Columbium is vital in the production of jet engines and gas turbines because of its quality of imparting strength at elevated temperatures to alloy steel. It is, therefore, of great strategic importance to both military defence and industry.

The separation of columbite, however, is complicated by its occurrence with other minerals of similar magnetic characteristics and comparable density. The Huntington Heberlein magnetic separator overcomes this difficulty because of its great selectivity, the result of well designed pole pieces, minimum particle interference and strong magnetic field. These features, together with wide air gap separation and vibration of feed band, ensure effective separation.

The machine is also widely used for the separation of wolfram from cassiterite and in the production of ferrotungsten where the purity of wolfram concentrates is of major importance.

Specialities include: Ore Concentration Plants, Metallurgical Plants, Ore Roasting Plants, Sintering Plants and Chemical Plants.

High intensity magnetic separators by

Huntington, Heberlein & Co. Ltd

SIMON ENGINEERING GROUP

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promise that mineralization might be wider than expected.

On the 500 foot level—the deepest at the mine—stope preparation was reported to be well advanced on No. 10 vein which supplies most of Kansanshi's current sulphide ore. Average values assigned to the ore on this vein were as high as 5.77 per cent copper. Diamond drilling also yielded encouraging results.

ALL EYES ON WALL STREET

On February 14, the *Dow Jones Industrial Index* stood at 462.14 or 66 points below the 1956 high of 521.05 and only 5.32 points above a low of 456.82 established during the same year. While considerable uncertainty is growing in the U.S. regarding the course of business activity in 1957, some observers are reported to be anticipating a stabilization of markets at an index level of 450.

Amongst the many factors put forward to explain this serious ebb in stock market confidence, perhaps the most important has been the failure of the motor industry to make its eagerly awaited recovery. Besides this, general industrial activity have recently shown signs of loosing its impetus, steel production is below its peak and company earnings in some cases have been regarded as disappointing. Profit margins have had to be trimmed as costs continue to mount and where prices have risen consumer buying resistance has been strongly evident.

The emergence of inflation in the U.S. is in fact the most pressing economic worry the Administration is currently facing. At a recent news conference, President Eisenhower, went so far as to suggest that price and wage controls may have to be imposed unless inflationary pressures abated. The imposition of physical controls is not taken seriously at the moment although some regulation of instalment buying by the Government is being canvassed.

Mainly under Wall Street's adverse influence London markets remained quiet last week and the *Financial Times Industrial Ordinary Index* lost only 1.5 points to 185. Mining issues generally lacked support with diamonds and coppers especially weak markets. Although tins held up well, some losses took place. A bright spot was provided by West African Mines which gained a few pence throughout the list on the better feeling about Ghana.

ST. HELENA SHAFT INTERSECTS NON-PAYABLE REEF

St. Helena Gold Mines has announced that the No. 2 shaft intersected the Basal Reef at a depth of 4,097 feet but that sampling of the reef yielded no payable values. The market reflected this disappointment yesterday. No long term significance can be read into the statement but it was generally hoped that the development of the north-eastern part of the property at depth would reveal good values.

CAMP BIRD'S RECORD EARNINGS

Camp Bird has announced the payment of a second interim dividend of 10 per cent, less tax. The company states that earnings are again a record and that consideration will be given, in due course, to payment of final dividend in respect of the 16 months ended April 30, 1957.

Financial News and Results

Kern Oil Bid.—The Kern Oil Company has stated that an English group with associates abroad is prepared to make an offer for the company's shares subject to certain conditions. The proposals are being considered.

Mawchi Proposes Option Extension.—Mawchi mines has proposed that the period during which its outstanding £233,395 of 6 per cent Ten Year Secured Notes may be exchanged into 4s. ordinary shares of par, should be extended until March 31, 1958.

Further Mines at Kinross.—The general manager of Union Corporation stated recently that if present indications were confirmed in the future, his company might open another two or three mines in the Kinross area, east of Springs. He also said that Union Corporation's Winkelhaak mine was reaching the development stage.

Cons. Zinc to Spend £A8,000,000.—Sulphide Corporation Pty.—a member of the Consolidated Zinc Corporation Group—is planning zinc smelting, sulphuric acid, and superphosphate developments at its Cockle Creek Plant, near Newcastle, New South Wales. The plant envisaged will involve capital expenditure in excess of £A8,000,000 and will have an ultimate output capacity of 47,000 tons of zinc metal per year. Superphosphate production would be expanded to a potential of 430,000 tons yearly. These plans are conditional upon negotiation of long-term arrangements for the transportation of concentrates by rail from Broken Hill, and for the provision of essential services. Subject to these considerations, the first smelting unit should be in production within three years, and the whole project completed within six years.

BERALT TIN & WOLFRAM LTD. has a vacancy at its mines in Portugal for a British mining engineer with good practical experience of "hard-rock" mining. Age 30/40. Salary £1,750 per annum or upwards according to age and experience, with good prospects. Applications to the Secretary, 8 Great Winchester Street, London, E.C.2.

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MINING MACHINERY

Expanding business in the mining division at the Company's Works at Stafford is creating an urgent need for mechanical and electrical engineers to work on the design and development of the latest types of winding machinery.

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Please reply to Central Personnel Services, 336/7 Strand, W.C.2, quoting Ref. M.J. 1216a.

MINING ENGINEER: Six years' experience hydraulic, mechanical, blasting, separation, office management, etc. Requires position, country district preferred. Box No. 594, The Mining Journal, Ltd., 15 Wilson Street, London, E.C.2.

METALLIFEROUS MINING SCHOLARSHIPS—Two awards of £300 and three of £150 p.a. from October, 1957 (provided by Metalliferous Mining Companies) for 3 years Metalliferous Mining Course at Royal School of Mines, for Degree and A.R.S.M. Application forms from Registrar, Imperial College, London, S.W.7, to be returned by March 31, 1957.

SURVEYORS. — Vacancies occur for Assistant Mine Surveyors for Gold Mine in West Africa. Salary according to qualifications and experience. First tour of fifteen months abroad followed by three months leave on full pay. Subsequent tours of 12 months. Wife of married man does not accompany on first tour but £180 allowance paid. Passages, furnished quarters and medical attention provided free. A Staff Assurance Scheme is in operation. Write stating age and experience to Box E8108, Whites, 72/78 Fleet Street, London, E.C.4.

HEAD OF MINING SECTION IN TRAINING BRANCH of N.C.B.'s Industrial Relations Department in London to develop training schemes for mineworkers (men and boys). Proved administrative ability, mining experience and technical qualifications in mining are required. Experience of industrial training schemes or in educational work with an industrial background would be an advantage. Appointment (superannuable) according to qualifications and experience, within inclusive range £1,454 to £1,820 male.

Write, with full particulars of age, education, qualifications and experience to National Coal Board, Staff Dept., Hobart House, London, S.W.1, marking envelope X/597/G, before February 25, 1957.

AGENCE MINIÈRE ET MARITIME S A

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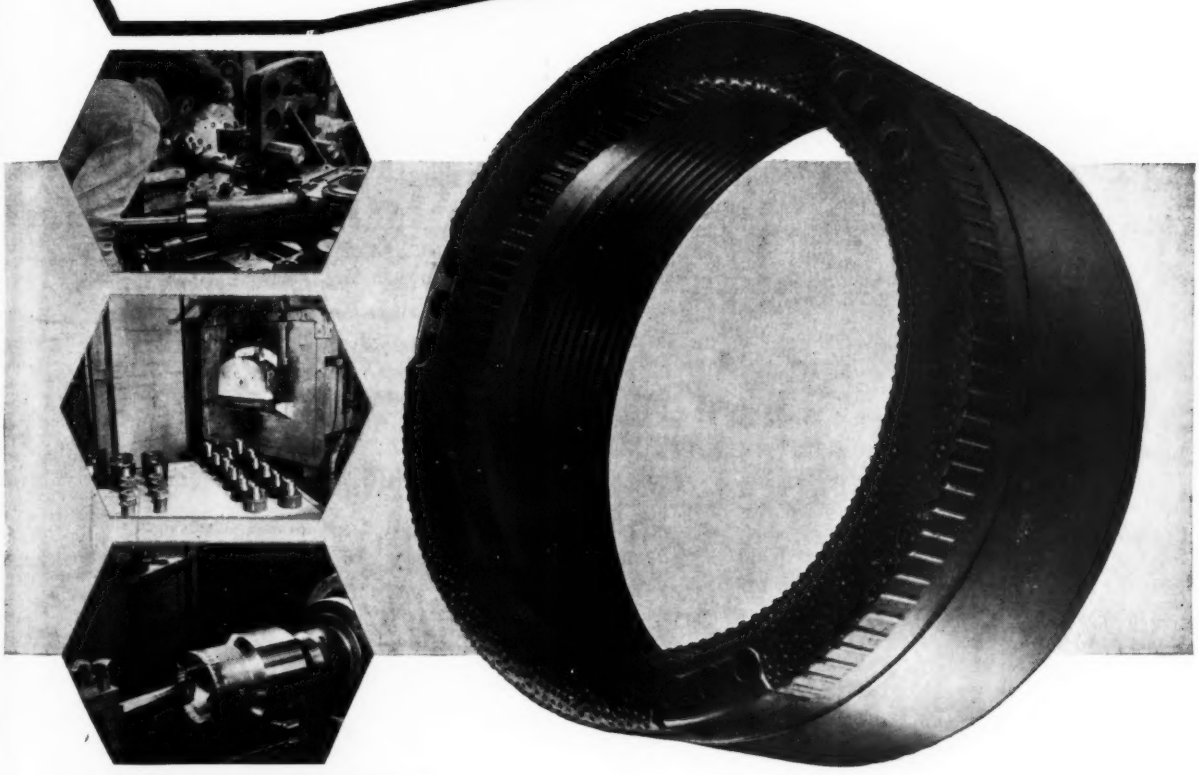

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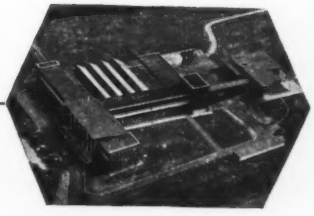

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SOUTHERN RHODESIAN GOLD RETURNS FOR THE QUARTER ENDING DECEMBER 31, 1956

Company	Oct./Dec. 1956			Months since year end	Current Financial Year Total to date			Last Financial Year Total to date		
	Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)	Tons (000)	Yield (oz.)	Profit (£000)
Arcturus	9·2	3,881	15·4	6	18·4	7,929	31·3	18·3	6,551	28·9
Cam & Motor	72·0	24,516	120·0	6	143·5	49,001	244·7	139·5	45,598	233·6
Falcon Mines *b*	57·4	10,685	30·2	3	57·4	10,685	30·2	55·2	9,822	28·4
Globe & Phoenix	19·4	11,068	60·2	12	74·5	44,529	269·0	72·9	39,728	258·5
Motapa Gold *c*	47·3	6,963	4·6	12	204·1	29,243	15·1	274·1	27,822	7·6
Muriel Mine	12·1	3,142	20·9	6	23·3	7,181	61·7	19·8	6,332	61·2
Phoenix Prince	32·4	3,700	6·5	9	105·7	10,965	20·4	97·3	11,462	30·2
Tebekwe (*a*)	0·5	1,603	3·3	6	1·1	3,519	8·7	36·4	5,973	20·7

(*a*) The greater part of the yield is obtained by treating sands.

(*b*) Including premium gold sales. At Sunace Mine development has ceased, and the mine is to be closed down after reclamation of pillars, remnants and equipment.

(*c*) Excluding Premium Revenue.

COAL OUTPUT FOR OCTOBER–DECEMBER 1956

Company	Oct./Dec. (in tons)	Months Since Year End	Cumulative Totals (in tons)	
			This year to date	Last year to date
Amal. Coll. of S.A.	1,509,652	12	6,376,996	6,881,884
Apex	225,555	12	871,005	1,014,650
Blesbok	151,776	12	617,636	552,277
Coronation	300,372	12	1,119,241	1,060,029
Natal Navigation	271,376	6	549,136	609,992
New Clydesdale	259,545	6	475,274	470,775
New Largo	328,831	12	1,387,068	1,213,651
S.A. Coal Est.	397,091	6	822,205	830,103
Springbok	221,728	12	882,994	870,541
Transvaal & Delagoa	358,755	4	470,958	492,089
Van Dyks Drift	182,594	12	680,658	707,512
Vierfontein	345,210	12	1,480,236	1,327,529
Vryheid Cor.	153,428	12	616,882	588,666
Vryheid Cor.*	125,325	12	503,964	477,073
Wankie Coll.	955,566	4	1,271,133	1,209,756
Wankie Coll.*	63,150	4	83,907	71,851
Witbank	417,875	12	1,731,366	1,787,148

* Coke

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★Results reported from adjacent mines often have a direct bearing on the one in which you are interested, which, however, can only become apparent if you have clearly in mind the position of all the properties in relation to one another.

★*The Technical Map Service*, located in Johannesburg, performs this service most effectively, for the Klerksdorp field. This map and its accompanying statistical handbook show :—

—the exact position of each mine on the field
—where in each property boreholes have been or are being sunk, how far they have gone and what the core recovery has been on reef intersection
—what shafts are being sunk, how far they have gone and what the final depth is expected to be.

Obtainable in London from The Mining Journal Price 25s. paper; 35s. linen (plus 1s. postage)